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PSYCHOLOGICAL LITERATURE.

Experimental Psychology, A Manual of Laboratory Practice, by EDWARD BRADFORD TITCHENER. Volume II, Quantitative Experiments: Part I, Student's Manual, Part II, Instructor's Manual. The Macmillan Company, New York, 1905. Student's Manual, pp. xli + 208. Instructor's Manual, pp. clxxi + 453.

In the field of quantitative psychology English and American literature has been relatively sterile. It would be interesting to determine to what causes this sterility is attributable, but for the present at least, we must forego the inquiry. Meantime in passing it may be remarked that this lack of productivity has been referred by certain presumably competent observers to a deep-seated Anglo-Saxon suspicion of the utility of the results gained by psychophysical science under the Teutonic auspices where it originated. Others have asserted that psychophysics required a larger measure of accurate patience and a broader acquaintance with mathematics than the average psychologist of British or American lineage possessed. Still others of a more amiable mood have assigned as a cause the more urgent appeal made to English and American temperaments by the less technical aspects of psychology. It could hardly rank as a bold speculation were one to suggest a combination of these considerations, together perhaps, with others of like ilk, as responsible for the extant situation. In any case, whatever the reasons, the facts are plain. Psychophysics has been chiefly a continental product and until recently almost exclusively German at that.

In the volumes now before us, Professor Titchener, who completes herewith his series of laboratory manuals, has made the first systematic contribution to quantitative psychology which has appeared in the English language on a scale sufficiently large to do justice to the subject. If it enjoyed no other distinction, this circumstance would entitle the achievement to high regard. But its claims to professional and scholarly consideration are of a more impressive kind. It seems to the reviewer a safe prophecy that these volumes, with the revisions which they are likely to undergo, will form for a generation at least the classical English treatment of the subjects with which they deal. Nor is this judgment indicative of entire agreement with the author upon the positions adopted in the text. It rests upon the breadth and solidity of the work and upon the lucidity of the exposition. One might quite conceivably differ from Professor Titchener on every important point in his books and still cherish the sincerest respect for his accomplishment and the most sensitive appreciation of the service he has rendered English-reading students of psychophysics. Indeed, the reviewer is not disposed to limit his sense of the usefulness of the volumes to readers of this language. How far, however, our foreign colleagues will profit by them remains to be seen.

Before entering upon a more detailed examination of the books and the author's positions upon the great controverted issues of psychophysics, it seems fit to comment upon the monumental labor which has been dedicated to the task of composition. This is the more appropriate in view of the disposition prevailing in sundry quarters to toss off psychological volumes between meals. The literary and

bibliographical completeness of these volumes, together with the ripe and sober estimates which they contain of complex problems, establish a most wholesome standard for English writing. In this particular they seem to the reviewer to mark a distinct advance upon their fore-runners, the volumes on qualitative investigations. The typographical work has also been well done, although errors are by no means wanting.

The first question of general significance raised by these treatises concerns the soundness and expediency of the division of the experimental field into a qualitative and a quantitative portion. The reviewer commented upon this matter in a notice of the earlier volumes, but it merits a further word in the light of the volumes now before us which reveal in complete form the author's conception of the distinction.

As the reviewer understands him Professor Titchener maintains that a knowledge of the quantitative relations of mental processes is as much a fundamental part of psychology as the knowledge of their qualitative peculiarities. The manuals themselves furnish the best evidence that from the practical point of view the division is not only feasible but also pedagogically useful and scientifically warranted. It enables one to present the field of experimental psychology with due regard to those lines of cleavage which have been historically significant and it reflects a distinction in methodological procedure that fully justifies recognition in some form as radical as this embodied in the author's devotion of separate volumes to its exposition.

If the isolation from one another of the quantitative and the qualitative experiments has any practical drawbacks, it is more likely that these will be found to inhere in the conveyance of exaggerated impressions of the ultimacy of the division and the exhaustiveness of the two branches of psychological inquiry. The two provinces are integral portions of the general psychological realm, however disparate their methods and aims may be. Moreover, there are other methods and points of view, *e.g.*, the genetic, which are equally valid and thoroughly promising. Of course considerations of this kind have weight only in connection with the more or less unconscious influences exercised by a text over the minds of young students. No one would think of accusing Professor Titchener himself of lack of breadth in his conception of the legitimate psychological methods.

On the theoretical side, the division raises a question of scientific classification which is intrinsically interesting and of peculiar import in this immediate instance because the reply given by our author [as will presently appear] is in reality based upon the most fundamental prepossession in his treatise, *i. e.*, the nature of mental measurement.

In our general works on psychology there is often no substantial distinction made between psychophysics and quantitative psychology. Nor is this strange when one remembers that until recently most of the English writing on matters pertaining to this range of problems was done under the controlling influence of Fechner for whom the dominant interests were psychophysical in the precise meaning of the term. From the point of view of our author, however, the distinction is at once real and pregnant. Psychophysics is but one chapter in a quantitative psychology. Strictly considered, the fundamental interest in psychophysics proper is always centered in the discovery of the quantitative relations between consciousness and the physical world, whether the latter is represented by processes in the animal body, or by the extra-organic molecular movements constituting a physiological stimulus. As distinguished from this conception of psychophysics quantitative psychology finds its problem in analyzing the quantita-

tive aspects of mental processes *per se* and quite apart from any overt reference to the physical world. It must be admitted that in actual practice the difference between the two forms of inquiry often dwindles to the vanishing point. But this does not invalidate the fact that the ultimate aims of the two are distinct. Moreover, in many cases the procedure is different. But however tenable this line of demarcation, if accepted, it instantly raises the question of the status of psychophysics in psychology. Does psychophysics fall definitely inside the range of psychology?

Whether psychophysics is to be accepted frankly into the family as a genuine member of the psychological flock obviously depends altogether upon one's conception of the scope of psychology. It is quite possible to view psychology in such a way as to render psychophysics at best a hermaphrodite form with a dubious position. For example, if one considers the proper business of psychology to be the analysis of consciousness conceived in common-sense severance from the world of physics, it would seem to follow that psychophysics as an end in itself must fall somewhat outside the barriers, or at all events must sustain to the main stream of psychological interest a purely ancillary relation. If one, on the other hand, accords to the jurisdiction of psychology anything which comes to hand in the search after knowledge about the mind, it is entirely possible to welcome psychophysics as an orthodox member of the fold. The definitions of most contemporary psychologists probably look toward the first conception, but their practice quite as certainly looks in the other direction. At least the reviewer recalls no psychologist who does not gladly invade any territory contiguous to his own when the raid promises booty of a valuable kind. This is illustrated constantly and somewhat flagrantly by the familiar citations of materials gained from neurology which can hardly by any stretch of the imagination be regarded as properly psychological ground, when one limits this ground to the immediate analysis of consciousness as such.

On the most fundamental and significant problem of the quantitative psychology, *i. e.*, the possibility of, and the nature of, mental measurement, the author is frankly a disciple of Delbœuf. The material of mental measurement is not sensation as such but (in the range of sensory processes, of which alone we shall speak here) sense distances, contrasts or relations between sense excitations. This view at once forestalls a basal weakness in the original Fechnerian position against which armies of critics have directed their fire. It avoids the necessity for defending sensation as itself a measurable magnitude. Indeed, it goes further and maintains, as do certain mathematicians, that such an isolated quantity as would be afforded by a sensation possessing magnitude of and by itself is absurd and impossible. Meantime it vigorously champions the measurable and quantitative nature of the sense distances.

The other half of the fundamental perplexity confronting a quantitative psychology [for the first point to which we have just referred is but a part of a larger whole], concerns the determination of a unit of measurement. This also is solved on Delbœufian lines by resort to increments of sense distances which prove in actual practice to be highly similar to the Fechnerian increments of sensation, although the conception of them is different in theory and their place in a psychophysics is different from that accorded by Fechner to his increments. Sensation is not itself regarded as constituted by integrated increments, but the sense distances are measurable in terms of noticeable incremental differences. The unit is arbitrary but justifiable because practicable.

Evidently the utility of such a unit will depend upon its equality over the whole range of sense excitation to which it may be desirable to apply measurement. This fact calls to mind the old familiar contest which Fechner carried on with his adversaries. He stoutly maintained that the increments were equal in different parts of the sense scale. Many of his critics have insisted that this contention flies directly in the face of the most obvious introspection, and to the rank and file of non-psychophysical psychologists their position has generally seemed valid. They urge as an insuperable difficulty the alleged fact that in the field of pressure sensations, for example, the just noticeable difference which enables us to discriminate a gram from some other heavier weight does not seem to us at all the same as the j. n. d., which permits us to distinguish between a weight of a hundred pounds and another proportionately heavier. On this issue Professor Titchener is a rather guarded upholder of the equality of the increments of sense distance throughout the intensive scale. His attitude is determined in part (so far as concerns the supraliminal distances) by his own introspective deliverances, and in part by the fact that the results of measurements made on the assumption that the increments are practically equal apparently substantiate the claim. At all events they do not militate against it. The reviewer cannot refrain from remarking that with regard to difficulties of the kind here involved a functional psychology occupies a peculiarly strategic position. A structural psychology may well be in doubt about the equality of the these j. n. d. increments. Functionally they are unquestionably equal and this would appear to be the point of really fundamental moment.

It has probably been evident that everything which has been said up to this point has direct and immediate bearing on the intensity relations of psychic processes. But the circumstances which attach to the quantitative relations of a spatial and temporal kind and to the serial arrangements of a qualitative sort are not sufficiently different in nature to necessitate a separate treatment at this juncture.

A large part of the discussion about mental measurement has been pertinent primarily to the theoretical rather than to the practical interests involved. Nor is the cogency of the outcome particularly flattering to the lucidity of the protagonists. Indeed, much of the controversial writing suggests souls calling to one another across oceans of misunderstanding, and unhappily the calls are not always agreeably toned at that. Professor Titchener's citations exhibit strikingly the extent to which utterly divergent and ultra-respectable scientific opinion may be cherished on the theoretical questions at stake. By something of a *tour de force* he manages to discover strains of agreement in a number of the important authorities, but the achievement has impressed the reviewer as the worthy effort of a peacemaker and a searcher for harmony, rather than as the disinterested registration of an obvious fact.

But whether one adopts the general views of Delbœuf, or of Wundt or Müller, or even of Fechner, there are many points in one's practical procedure which might remain substantially unaltered. For example, one might employ the method of minimal change without essential modification, whether one were primarily engaged in determining a limen in the sense of Fechner, or a serial determination of intensive sense distances in Delbœuf's sense. Of all of which the point is that one must distinguish sharply between questions of technique in procedure and questions of theory as regards the status of quantified method in psychology. The two issues are of course vitally related from the standpoint of any ultimate view, but an agreement on prac-

tical procedure is as compatible with divergent beliefs about the theoretical matters involved, as is agreement about physical measuring with discrepant notions of the nature of matter. On the question of practical procedure, there is already extensive agreement and doubtless will speedily be more as the real basis of the differences of opinion becomes clarified. On the underlying problems of a theoretical character the decadence of controversy will probably be much slower, but fortunately it is practically much less important.

It would be pretentious to attempt an exhaustive critique of Delbœuf's view of the subject of mental measurement, but a mere word of commentary may be permitted. Passing over such refinements of criticism as Meinong's (not as valueless, but as momentarily irrelevant), and disregarding the advocates of mental mensuration as primarily applicable to processes of judgment and apperception (for whose views there is much to be said), it appears that the position of Delbœuf, while superior to its predecessors as a practical working foundation, has not altogether escaped certain of the limitations which hedged them about. Two of these may be mentioned.

In the first place, however strenuously it may be urged that these Delbœufean measurements are mental and not physical measurements, it still remains true that all expressions of them, all tangible results of them must be formulated with the assistance of physical terms. This is perhaps nothing to their discredit as compared with physical measurements, which require not only physical units, but also an observing mind to make the measurements. The two are at quits on this score. But the facts warrant notice whenever emphasis is being put upon the *purely* mental character of the Delbœufean measurements. Physical stimuli are constantly in evidence whenever specific quantitative terms are desired. Nor do we forget in making this assertion that these stimuli are employed as means and never as ends in themselves. But pure mental quantification is apparently an invertebrate form which requires the stiffening of some kind of physical spine in order to render it practically available.

In the second place, the sense distance which is the measurable magnitude under this theory, psychologically considered, is something of an artifact, as were the Fechnerian increments of sensation. This does not prevent its successful employment for the purpose in hand (nor were the increments of Fechner intrinsically impractical), but it does in a degree affect its status as a psychological term. To illustrate, when one light is sensed as brighter than another just preceding, it does not seem to correspond to anything commonly experienced when the second light is apprehended, to say that the distance of the one from the other on an intensive scale is thereby established; nor is the situation altered by any such considerations as those set forth in Professor James' description (closely resembling in its immanent psychology certain of Fechner's conceptions) of the second sensation as being a sensation of light-B-brighter-than-light-A. It is felt as brighter without doubt, but in this awareness of superior brightness there is no necessary consciousness of the distance between the two as sense distance. That is to say, the immediate conscious reaction is "brighter," but the quantitative ranging of the experiences on an intensive scale, which is in some form or other essential to measurement, is a sophisticated afterthought of the professional psychologist. To read it in as a regular feature of intensive comparisons is to commit the psychologist's fallacy in a peculiarly obvious way.

To this line of attack Professor Titchener has already prepared a reply which relies for its force upon the contention that we often make quantitative judgments without being conscious of the quantity as

quantity. The reviewer does not challenge this assertion but he raises the previous question and remarks that whereas the Fechnerian conception of mental measurement has frequently been characterized as in reality physical measurement, the Delbœufian conception in its turn offers a somewhat vicarious type of measurement, inasmuch as the serial arrangement indispensable to the real measuring process is often not overtly present at all to the consciousness upon which the measurements are being executed. These comments are offered in no spirit of hostile criticism, for the reviewer's attitude is distinctly sympathetic towards the Delbœufian view, but simply to emphasize the fact that there are residual difficulties, or at least limitations, for this theory as well as for its forerunners.

On one rather important matter closely related to the preceding topic, Professor Titchener seems to have fallen into a curious inconsistency. He says (*Student's Manual*, p. vi) that the question asked of consciousness in quantitative experiments is never the direct question 'how much,' but *always* one or other of the two questions 'present or absent' or 'same or different.' But on page 56 of the same book in describing the procedure for a test on the DL for brightness he speaks of the O saying at a certain point 'lighter.' And again on page 106 in giving directions for tests on the DL for pressure he says the "judgments may take the form 'much greater,' 'greater,'" etc. Now the reviewer has no desire to invest time in assailing a man of straw and the author probably has some ready explanation for this seeming contradiction in his utterances. But whatever the facts as regards this part of the question, it appears to be reasonably evident that only on the basis of the ability of consciousness to give judgments of the "greater" or "less" type does it become possible to speak of conscious processes as being properly subject to arrangement in a quantitative series. It is perhaps possible so to devise one's experiments that the verbal reaction shall always be either "present or absent" or "same or different." But the actual conscious reaction either involves directly the quantitative predicate, implicitly if not on every occasion overtly, or consciousness is not susceptible to genuinely quantitative treatment. Even if one attempts so to arrange one's procedure that the question "how much" is never directly asked, there are certain experiments, *e.g.*, those on equality of spatial distances, in which this query insists on impinging upon the consciousness of the O, however scrupulously the E has endeavored to avoid it.

Before examining the detailed arrangement of his work we may note that Professor Titchener does all he can to aid in the worthy effort to put Weber's law in the subordinate position which it really deserves to occupy. German psychologists have for a long time ascribed to it a position of secondary importance, but in the writings of English and American psychologists it has persisted in monopolizing the foreground as constituting substantially the alpha and omega of accomplishment in quantitative psychology. To be sure this attitude is often varied by recognition that its demonstrated validity is limited to certain ranges of sense experience and valid therein only on terms of sufferance for irregularities. But even so it looms large. To the reviewer this fact seems attributable without serious doubt to the philosophical and cosmological interpretations accorded it. In any event we appear to be entering upon a period of larger enlightenment concerning the merits of the case.

Turning to the organization of the books we find that the volumes fall into three principal chapters of which the first is entitled "Preliminary Experiments" and consists of illustrative determinations of qualitative and intensive limens. The second is devoted to the metric

methods and contains experiments illustrative of all the more important forms of quantitative procedure in the realm of sensation, and the third is given over to reaction experiments from the quantitative point of view, including a rather extensive expository account of electrical units and methods. A final and much briefer chapter discusses the psychology of time from the same standpoint. In addition to these divisions, the Instructor's Manual has an elaborate and invaluable introductory account of the rise and progress of quantitative psychology, which constitutes essentially a critical history of psychophysics, and this finds a much briefer counterpart in an introductory section in the Student's Manual describing the field of measurement in general and psychological measurements in particular. The Instructor's Manual has also a chapter on typical experiments in quantitative psychology and three appendices dedicated to examinations, books, instruments and dealers in them. Indices of various kinds complete the useful machinery with which the volumes are provided.

The amount of space reserved for discussion and explanation of electrical apparatus and electrical principles will no doubt appear to certain instructors excessive, while others will feel that the space devoted to purely mathematical exposition is unnecessarily extended. But the author has the comfort of knowing that no course which could be selected would please every one on this score. Meantime in the reviewer's opinion the plan pursued is altogether judicious and profitable. The unfathomed ignorance of the average student concerning the facts in the case passes belief unless one has for some years given instruction to classes in laboratory psychology.

So far as the reviewer has any quarrel with the portions of the text which deal with apparatus his criticism would be directed at the failure to characterize certain pieces as frankly as his own experience would warrant. The difficulties are no doubt often the fault of the mechanic and not defects in the theory of construction. But the results for the unsophisticated purchaser are one and the same. Thus, for instance, the Zeitsinn apparatus pictured on page 399 of the I. M. is by no means always so constructed as to permit satisfactory results. Nor does the author's reason for introducing Scripture's touch weights (S. M. p. 15.) seem convincing. He admits in a comment in the I. M. that the apparatus is unsatisfactory. The reviewer has encountered many sets of these weights and while he is certain that occasional sets must have been so constructed as to give reliable results, he is equally certain that the average set converts the experiment into a farce. So, too, the cartridge weights mentioned for experiments on pressure on page 189 of the I. M. have the advantage of cheapness and the endorsement of wide use, but they almost invariably wobble if used for any of the higher weights, *e. g.*, 100 grams, and they commonly require a pad to minimize temperature effects. This pad seldom transmits the pressure equally over the various parts of its surface. The same kind of limitation holds true of other pieces of listed material. Criticism of this sort would be sheer carping were not the author's dictum on these subjects so often taken uncritically as gospel. In consequence, a higher degree of responsibility rests on him than falls to the lot of most of us.

On one matter of practical importance to students *i. e.* the subjective criterion of assurance, the writer could wish that the author had given more specific instructions and advice. The difference between doubt and assurance is nowhere more strikingly brought out and nowhere in the realm of psychological studies more significant than in the case of quantitative experiments. Shall one, for example, establish his standard for judging that two sensations are intensively

different a conviction altogether unalterable, or shall one employ an attitude of practical assurance similar to that with which one accepts as true the recollection of one's whereabouts a week ago, or, finally, shall one cultivate a more highly sensitive appreciation and give a positive judgment whenever one suspects a balance in favor of a difference? Any one of these attitudes may give relatively consistent results if adopted and conscientiously carried through. But there is of course a choice and there may be other attitudes still more judicious.

In the writer's experience the personal equation comes in here in a very disturbing manner and students are nonplussed and often discouraged, if not disgusted, to find that several of them have been proceeding in diverse ways when supposedly using similar methods. Moreover, the difficulty is likely to obtrude itself on the student's attention despite every precaution on the part of the instructor. Of course every teacher gives his own students directions upon this familiar difficulty of quantitative work, but a fuller discussion than has been offered by Professor Titchener would have been most welcome and of the greatest value in its tendency toward uniformity of understanding if not of procedure. Apart from the purely psychological issue involved, the point really raises the whole question of the nature of certain of the measurements and the part played by errors of observation.

On the important matters relating to the specific psychophysical methods the author has obviously been much influenced by Professor G. E. Müller. These questions are taken up in the second main part of the texts. In the S. M. attention is chiefly confined to directions for the application of the technique. The I. M., as was noticed above, offers a most valuable historical and critical exegesis. The methods are discussed under the following headings: (a) the method of limits in its various forms (at present commonly designated in English as the method of minimal change); (b) the method of average error with its subordinate form the method of equivalents; (c) the method of equal sense distances generally known in connection with its several modes as the 'gradation methods;' and (d) the method of constant stimulus and constant stimulus differences, historically familiar as the method of right and wrong cases.

To readers accustomed to the older nomenclature the terms used to designate the different methods seem somewhat strange and possibly a trifle cumbersome. But on the whole (with one possible exception, *i. e.* certain of the forms of minimal change) they are intrinsically distinct improvements upon those commonly in vogue, for they suggest more immediately and less ambiguously than do these the essential characteristics of each.

As is well known, the proposed classification of the methods are almost as numerous as the psychophysical investigators. From the student's point of view, the main consideration is that the classification offered shall display the relations most essential for both theory and practice in an intelligible manner, and this result is accomplished successfully by the arrangement adopted by our author. It possibly tends, however, to emphasize differences at the cost of obscuring similarities, and the reviewer is strongly of the opinion that a more overt and explicit discussion than occurs anywhere in the text justifying the usage employed would have been a great boon to students and a material addition to the value of the treatises. The author's labors peculiarly fit him to handle with lucidity and relative ease the complex problems and relations involved.

As compared with Professor Titchener's previous books, the pres-

ent volumes suggest a higher nervous tension in composition. He has evidently welcomed the opportunity to free his mind on a number of subjects in which his emotions are somewhat concerned. The criticisms are often sharp to the point of the caustic and more personally toned than heretofore. This tendency, suggestive of the fruits of long contact with German usages and particularly with Professor G. E. Müller, that acrimonious guardian of the psychological fold, the reviewer regards with chastened enthusiasm. To be sure the technical tedium of the text is considerably relieved by these excursions, but the books were not written primarily for entertainment. For the most part, be it said, the criticism is perfectly objective, as scientific criticism seemingly should be. Moreover, the author sins as little in this way as any psychologist known to the writer.

In conclusion the reviewer is moved to express a measure of dissent from Professor Titchener's estimate of the importance of the spread of interest and proficiency in quantitative psychology. The difference is perhaps largely one of degree of emphasis. To the writer it does not seem probable that the extended development of quantitative investigations is an immediate *sine qua non* of further progress in psychology. So far as these methods invite and stimulate exactness and accuracy and appreciation of scholarly modes of work, so far will a wide-spread familiarity with them in psychological circles be rewarded by an increase in the amount and scientific character of the output of our investigators. The reviewer has always felt the most unreserved confidence in the improvement which would accrue to the qualitative studies from a more thorough acquaintance with the quantitative procedures. As every experimentalist knows, there is hardly a problem in qualitative psychology in which some trace of the quantitative element is not to be found, and in practically all experiments, a regard for the canons of such procedure is indispensable to trustworthy results. For their general tonic effects, therefore, as well as for their practical utility in qualitative research, the reviewer looks with great hopefulness upon the development of interest in quantitative methods and problems. Nor would the reviewer be understood as depreciating the value of quantitative work on its own merits and for its intrinsic worth. Quite the contrary. But as the writer understands him, Professor Titchener would take a more extreme and positive attitude, with the conviction that we have gone about as far as we safely can without assistance from the quantitative side. The reviewer feels that there is yet much useful pioneer work to be done before the nicety of the quantitative methods can be summoned to trim up the edges. All this is matter of opinion pure and simple and time alone will determine the more correct estimate. For better or for worse there can be no question that these volumes will instigate a large amount of intelligent interest where before there was nothing but ignorance and hearsay. And no doubt, too, out of this new-born interest will blossom much research of a high order. For all this and for much more Professor Titchener will have our gratitude and appreciation.

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L'Attention, by W. B. PILLSBURY. *Bibliothèque internationale de psychologie expérimentale*. Octave Doin, Paris, 1906. pp. 299.

Professor Pillsbury and his pupils at the University of Michigan, have for some time been devoting experimental study to the so-called fluctuations of attention. The present book, however, refers only in passing to this work; it is a general treatise undertaking to summarize the facts about attention and to include them under a theory. The facts are grouped in the first eight chapters, entitled 'The